



The CEA ([cea.fr](http://cea.fr)) is a major French research agency and IRIG ([cea.fr/drf/irig/pages/presentation.aspx](http://cea.fr/drf/irig/pages/presentation.aspx)) is one of its institutes, devoted to fundamental research, in the Grenoble Minatec ([minatec.org](http://minatec.org)) area. The ESRF (European Synchrotron Radiation Facility, [esrf.eu](http://esrf.eu)) is a multinational research institute, situated in Grenoble, France. It operates one of the most powerful synchrotron X-ray source. It offers a highly dynamic, exciting and multinational working environment in the French Alps.

**Within the French beamlines at the ESRF, the CEA is seeking to recruit a:**

**Post-Doctoral Fellow (f/m):**

***In situ* synchrotron X-ray monitoring of the growth of defect-free two-dimensional materials**

## THE SUBJECT

Two-dimensional materials (2DM) such as graphene, boron nitride, silicene or transition metal dichalcogenides (TMDCs) like  $\text{MoS}_2$  are new very promising materials that find applications in multiple branches of modern chemical, electronic and material industry. Thanks to their unique electronic, mechanical, and thermal properties, they are considered as materials of the future for new electronic and biodevices, super-strong materials, and energy storage. However, despite rapid progresses in their synthesis, the quality and the size of single 2DM sheets is still unsatisfactory, which evidences an urgent need of developing new methods for their fabrication, allowing to obtain large-scale and defect-free 2D crystals.

This project is in the continuity of a PhD-thesis aimed at better understanding the combined MBE/CVD growth of TMDCs on the one hand, and of an ongoing European H2020 FET-open project aimed at developing the growth of defect-free graphene on liquid metals on the other hand. The subject will be to investigate the growth and the structure of new TMDCs during their *in situ* growth by combined MBE/CVD, with the goal of improving the atomic structure. This work will be performed in close collaboration with three research groups that are very active in the field: that of Athanasios Dimoulas (DEMOKRITOS, Athens, Greece), that of Johann Coraux (Institut Néel, CNRS, Grenoble) and that of Matthieu Jamet (IRIG, CEA, Grenoble).

## THE FUNCTION

You will make use of a combined UHV-chamber/Molecular Beam Epitaxy (MBE) /Chemical Vapour Deposition (CVD) growth reactor located at the European Synchrotron (ESRF) in Grenoble. This “hybrid” reactor is coupled to a diffractometer and a high-energy X-ray synchrotron beamline (BM32). It allows detailed studies of the atomic structure/morphology of 2D layers or nanoparticules using grazing Incidence X-Ray diffraction/Scattering (GIXD/GIXS/GISAXS) and X-ray Reflectivity, in particular *in situ* during their growth or *operando*. This instrument has been fully renewed recently thanks to a “Equipement d’Excellence” funding from the French state. The experimental work will be centred at the ESRF facility. You will learn to master the control of the beamline, surface diffractometer and reactor chamber. You will work in close collaboration with a team of research and assistant engineers, as well as scientists working in the field. You will occasionally be asked to help teams of external users that get access to this facility through research

proposals and scientific committees. You will also be in close contact with the team of postdocs and PhD fellows working in another ESRF laboratory on the growth of 2D materials on liquid metals surfaces.

## QUALIFICATIONS AND EXPERIENCE

You should hold a PhD in physics, chemistry or material science or closely related science. Previous experience of complex instrumental environment, MBE or CVD growth methods and / or with synchrotron X-ray scattering / diffraction / reflectivity, especially on surfaces will be an advantage.

You should be motivated to work with an experimental setup at the forefront of instrumental development.

You should also have experience or show some interest in learning data analysis and analysis program development using e.g. Python programming.

In addition, you should have:

- Knowledge of relevant research topics in solid state physics or surface science;
- Ability and initiative to get to the heart of the problem and take it effectively through to completion;
- Good interpersonal, communication and presentational skills;
- Good organizational and planning skills;
- Ability to interact effectively with others;
- Ability to work as part of a multi-disciplinary team;
- Self motivation.

## APPLICATION:

This is a full time CEA contract, renewable each year, located at ESRF, France

Interested applicants should submit

- (1) 1 page cover letter stating motivation, research experience and goals, and anticipated available date;
- (2) curriculum vitae, and
- (3) contact information for 3 references (reference letters are not required at this time)

to Gilles Renaud:

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**Application deadline: December 15, 2019**